

WHAT IS CLAIMED IS:

1. A method of producing a plurality of semiconductor elements by individually dividing said semiconductor elements formed on a substrate, said method comprising steps of:

5 removing semiconductor layers on parting lines so that (i) only an electrode-forming layer on a side near said substrate remains or (ii) no semiconductor layers remains on said parting lines;

10 forming a protective film so that said semiconductor layers are covered with said protective film and said protective film can be removed by an after-process;

scanning said substrate with a laser beam along said parting lines to form separation grooves in a front surface of said substrate; and

15 removing said protective film and unnecessary products produced by said laser beam scanning,

wherein said separation grooves formed along said parting lines by said laser beam scanning are used for dividing said substrate into individual semiconductor elements.

20 2. A method of producing a plurality of semiconductor elements according to claim 1, wherein the semiconductor layer removal step is carried out in an electrode-forming etching process for exposing an electrode-forming portion of an
25 electrode-forming layer on a side near said substrate by etching.

3. A method of producing a plurality of semiconductor elements according to claim 1, wherein in the semiconductor layer removal step, electrode-forming layer side part of said substrate on said parting lines is also removed by dicing.

4. A method of producing a plurality of semiconductor elements according to claim 1, wherein rear grooves corresponding to said separation grooves are formed in a rear surface of said substrate after the protective film and unnecessary product removal step.

5. A method of producing a plurality of semiconductor elements according to any one of claim 1, wherein a rear surface of said substrate is polished to reduce the thickness of said substrate after the protective film and unnecessary product removal step so that said substrate can be divided into individual semiconductor elements by use of only said separation grooves formed in said front surface of said substrate.

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6. A method of producing a plurality of semiconductor elements according to any one of claim 1, wherein a rear surface of said substrate is polished to reduce the thickness of said substrate after the protective film and unnecessary product removal step and rear grooves corresponding to said parting

lines are then formed in a rear surface of said substrate.

7. A method of producing a plurality of semiconductor elements by individually dividing semiconductor elements formed on a substrate, said method comprising a step of performing a polishing or blasting process with respect to separation grooves after forming said separation grooves by laser beam irradiation.

8. A method of producing a plurality of semiconductor elements according to claim 7, wherein:

said separation grooves are formed in a rear surface of said substrate opposite to a front surface of said substrate on which semiconductor layers and electrodes are formed; and

said polishing or blasting process is applied to said rear surface.

9. A method of producing a plurality of semiconductor elements according to claim 7, wherein:

when said blasting process is used, particles used in said blasting process are selected so that a medium value of diameters of said particles is equal to about a half width of each separation groove.

10. A method of producing a plurality of semiconductor

elements according to claim 7, wherein said substrate is a sapphire substrate.

11. A method of producing a plurality of semiconductor
5 elements according to claim 7, wherein:

when said blasting process is used, particles used in said blasting process are mainly of alumina or silicon carbide.

12. A method of producing a plurality of semiconductor
10 elements by individually dividing said semiconductor elements formed on a substrate, said method comprising steps of:

removing semiconductor layers on parting lines so that
(i) only an electrode-forming layer on a side near to said substrate remains on said parting lines or (ii) there is no
15 semiconductor layer on said parting lines; and

scanning said substrate along said parting lines with a laser beam to thereby form broken line-shaped or dot line-shaped separation grooves,

wherein said broken line-shaped or dot line-shaped
20 separation grooves formed by laser beam scanning along the parting lines are used so that said substrate is divided into individual semiconductor elements.

13. A method of producing a plurality of semiconductor
25 elements according to claim 12, wherein the semiconductor layer

removal step is carried out by an electrode-forming etching process for exposing an electrode-forming portion of said electrode-forming layer by etching.

5 14. A method of producing a plurality of semiconductor elements according to claim 12, wherein in the semiconductor layer removal step, a part of the element-forming surface of said substrate on said parting lines is also removed by dicing.

10 15. A method of producing a plurality of semiconductor elements according to claim 12, further comprising steps of:

 forming a protective film so that layers formed on a front surface side of said substrate are covered with said protective film before the laser beam scanning step and said protective
15 film can be removed by an after-process; and

 removing said protective film and unnecessary products produced due to laser beam scanning after the laser beam scanning step.

20 16. A method of producing a plurality of semiconductor elements according to claim 12, wherein before said separation grooves are used for dividing said substrate into elements, rear grooves corresponding to said parting lines are formed in a rear surface of said substrate.

17. A method of producing a plurality of semiconductor elements according to claim 12, wherein before said separation grooves are used for dividing said substrate into elements, a rear surface of said substrate is polished to reduce a thickness of said substrate so that said substrate can be divided into individual semiconductor elements only by said separation grooves formed in the front surface of said substrate.

18. A method of producing a plurality of semiconductor elements according to claim 12, wherein before said separation grooves are used for dividing said substrate into elements, a rear surface of said substrate is polished to reduce a thickness of said substrate and then rear grooves corresponding to said parting lines are formed in the rear surface of said substrate.

19. A method of producing a plurality of semiconductor elements by extracting said plurality of light-emitting elements from a semiconductor wafer formed by lamination of a plurality of nitride compound semiconductor layers on a crystal growth substrate, said method comprising a step of applying a laser beam on a metal layer formed on said semiconductor wafer and serving as a negative electrode of each of said semiconductor elements to thereby form continuous line-shaped, dot line-shaped, broken line-shaped or cross-shaped separation grooves for separating said semiconductor wafer into said

plurality of semiconductor elements.

20. A method of producing a plurality of semiconductor elements according to claim 19, wherein:

5 said method further comprises the step of laminating said metal layer on an approximately entire outer circumference of each of said semiconductor elements before division so that said metal layer is circled over said approximately entire outer circumference of each of said semiconductor elements; and
10 in said laser beam applying step, said separation grooves are formed so that each of said separation grooves is circled over said approximately entire outer circumference of each of said semiconductor elements.

15 21. A method of producing a plurality of semiconductor elements according to claim 19, further comprising steps of:

 forming a protection film for covering a front surface of said semiconductor wafer before said laser beam applying step; and

20 removing said protective film after said laser beam applying step.

 22. A method of producing a plurality of semiconductor elements according to claim 19, further comprising a step of
25 polishing a rear surface of said crystal growth substrate to

make said crystal growth substrate thin.

23. A method of producing a plurality of semiconductor elements according to claim 19, further comprising a step of forming parting lines in said crystal growth substrate from the rear surface of said crystal growth substrate so that said parting lines face said separation grooves respectively.

24. A semiconductor element extracted from a semiconductor wafer formed by lamination of a plurality of nitride compound semiconductor layers on a crystal growth substrate, wherein said semiconductor element is produced by a production method defined in claim 19.

25. A semiconductor element according to claim 24, wherein:

said semiconductor element is a wire-bonding type semiconductor element; and

said semiconductor element includes an outer circumferential negative electrode having an enclosure shape for enclosing a light-emitting portion at least partially from the outside.

26. A semiconductor element according to claim 24, wherein:

said semiconductor element is a flip chip type
semiconductor element provided with a translucent substrate;
and

said semiconductor element includes an outer
5 circumferential negative electrode having an enclosure shape
for enclosing a light-emitting portion at least partially from
the outside.

27. A semiconductor element according to any one of
10 claims 25 and 26, wherein said outer circumferential negative
electrode is formed to have a height at least equal to a height
of a light-emitting layer on a side of at least one side wall
of said light-emitting layer.

15 28. A semiconductor element according to claim 27,
wherein at least one part of said outer circumferential negative
electrode is formed on said side wall through an electrically
insulating film.